

US011560059B2

(12) **United States Patent**
Kim et al.

(10) **Patent No.:** **US 11,560,059 B2**
(45) **Date of Patent:** **Jan. 24, 2023**

(54) **APPARATUS FOR DEPLOYING A DISPLAY UNIT**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **17/512,362**

(22) Filed: **Oct. 27, 2021**

(65) **Prior Publication Data**

US 2022/0212538 A1 Jul. 7, 2022

(30) **Foreign Application Priority Data**

Jan. 6, 2021 (KR) 10-2021-0001359

(51) **Int. Cl.**
B60K 35/00 (2006.01)
H05K 5/00 (2006.01)
H05K 5/02 (2006.01)

(52) **U.S. Cl.**
CPC **B60K 35/00** (2013.01); **H05K 5/0017** (2013.01); **H05K 5/0217** (2013.01); **B60K 2370/152** (2019.05); **B60K 2370/73** (2019.05)

(58) **Field of Classification Search**

None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,735,432 B2 * 6/2010 Jin B60R 11/0235
248/188.4
7,869,129 B2 * 1/2011 Lebreton G02B 27/0149
359/632
8,485,486 B2 * 7/2013 Riedel B60R 11/0235
361/7
8,649,161 B2 * 2/2014 Kato H04N 21/41422
345/905
8,991,951 B2 * 3/2015 Lee F16M 11/18
348/839
9,592,771 B2 * 3/2017 Guering B64D 43/00
9,618,975 B2 * 4/2017 Su H04M 1/0266

(Continued)

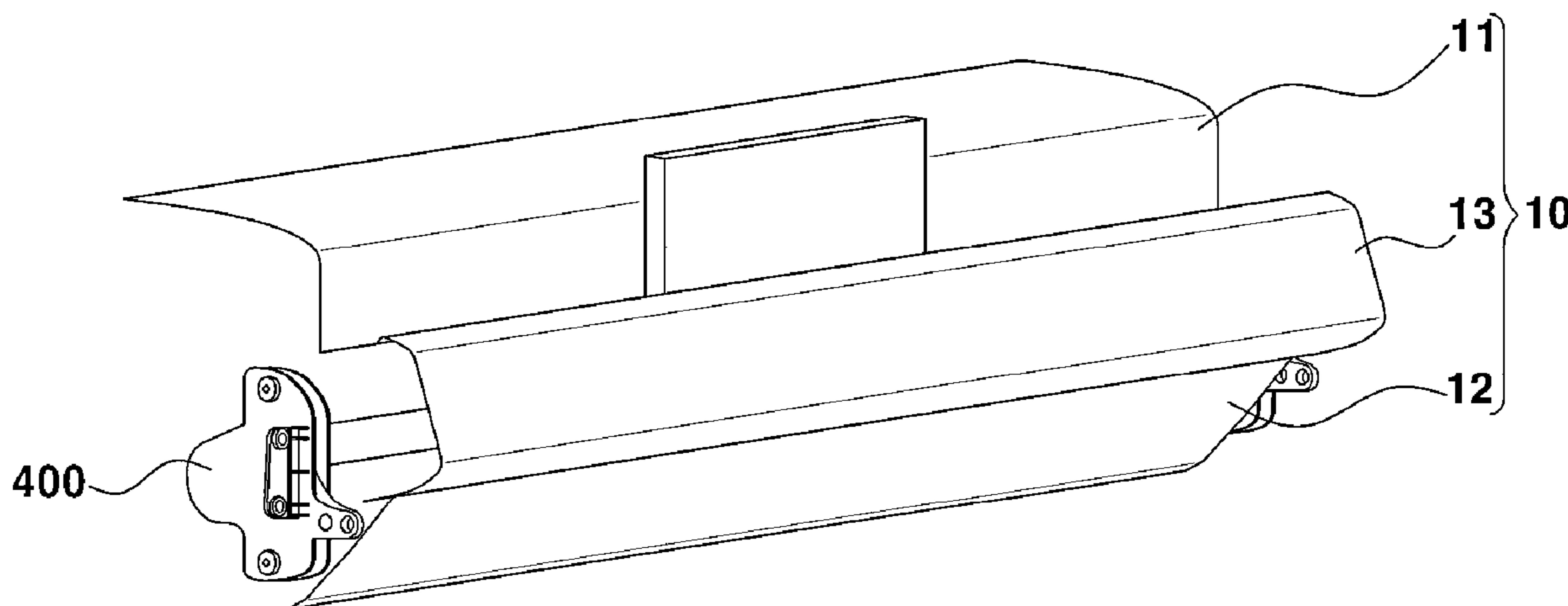
FOREIGN PATENT DOCUMENTS

KR 101640053 B1 7/2016
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(57) **ABSTRACT**

An apparatus for deploying a display unit includes: a cowl cross bar disposed inside a crash pad; a housing disposed on the cowl cross bar and fastened to a center part of the crash pad; a display unit configured to be deployed along the housing; a rotating unit configured to rotate the housing with respect to the cowl cross bar; a driving unit coupled to the cowl cross bar in order to cause sliding movement of the cowl cross bar; and a controller configured to control at least one of the extent of deployment of the display unit, the amount of sliding movement of the cowl cross bar, or the amount of rotation of the housing.

12 Claims, 5 Drawing Sheets



(56)

References Cited

U.S. PATENT DOCUMENTS

9,731,602	B2	8/2017	Kim et al.	
9,989,761	B2 *	6/2018	Yomogita	F16H 19/001
10,416,459	B2 *	9/2019	Tatekawa	G02B 27/0149
10,451,873	B2 *	10/2019	Park	B60K 37/04
10,656,419	B2 *	5/2020	Han	B60K 35/00
10,663,726	B2 *	5/2020	Shin	B60R 11/02
10,671,179	B2 *	6/2020	Xia	G06F 3/03547
11,166,388	B2 *	11/2021	Diboine	G09F 9/301
11,178,782	B2 *	11/2021	Song	H05K 5/0217
11,224,136	B2 *	1/2022	Song	B60K 35/00
11,259,420	B1 *	2/2022	Copeland	H05K 5/0217
2014/0085787	A1 *	3/2014	Kato	B60R 11/0235 361/679.01
2016/0193924	A1	7/2016	Kim et al.	
2018/0364479	A1 *	12/2018	Kwak	G02B 27/0149
2020/0189661	A1 *	6/2020	Kong	B62D 25/145
2021/0206265	A1 *	7/2021	Song	B60K 35/00

* cited by examiner

FIG. 1

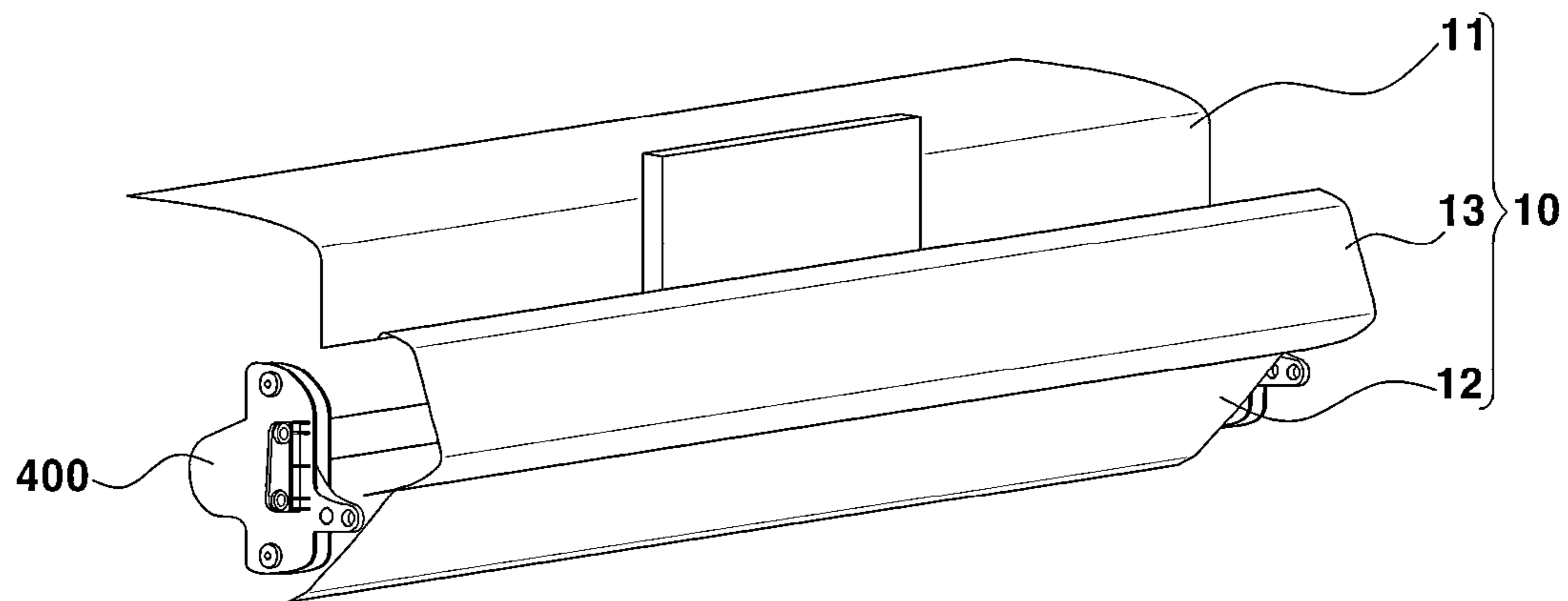


FIG. 2a

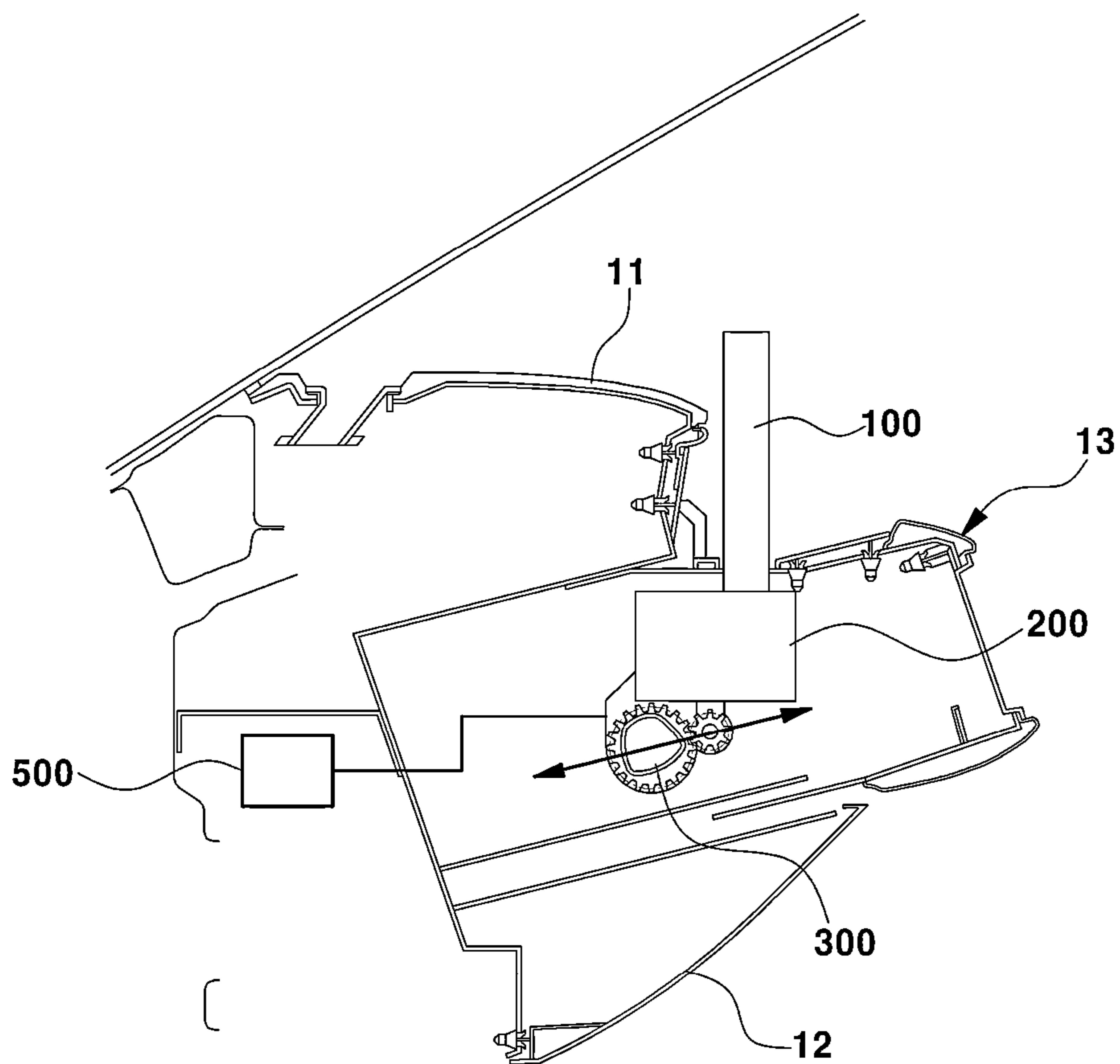


FIG. 2b

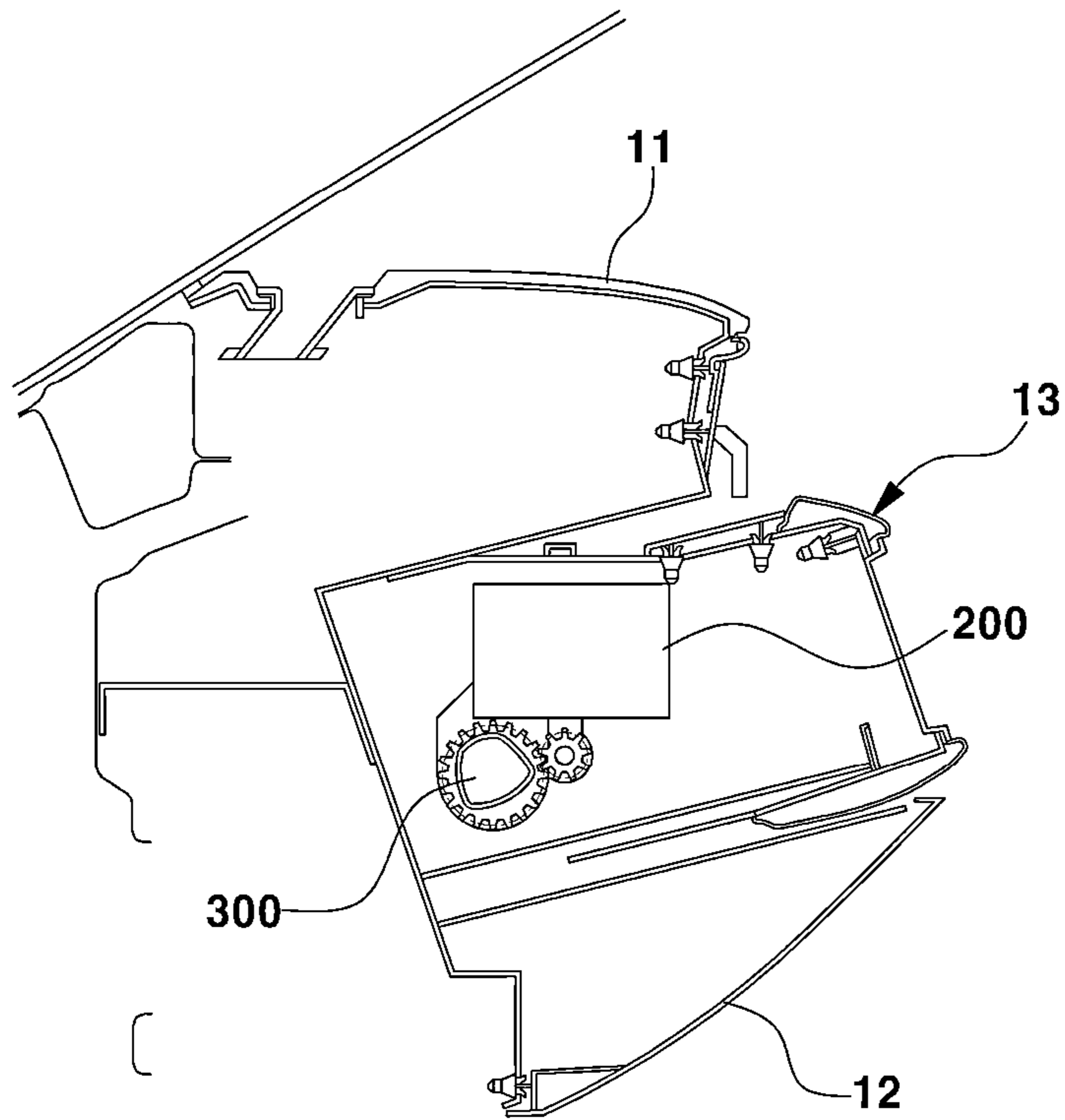


FIG. 3

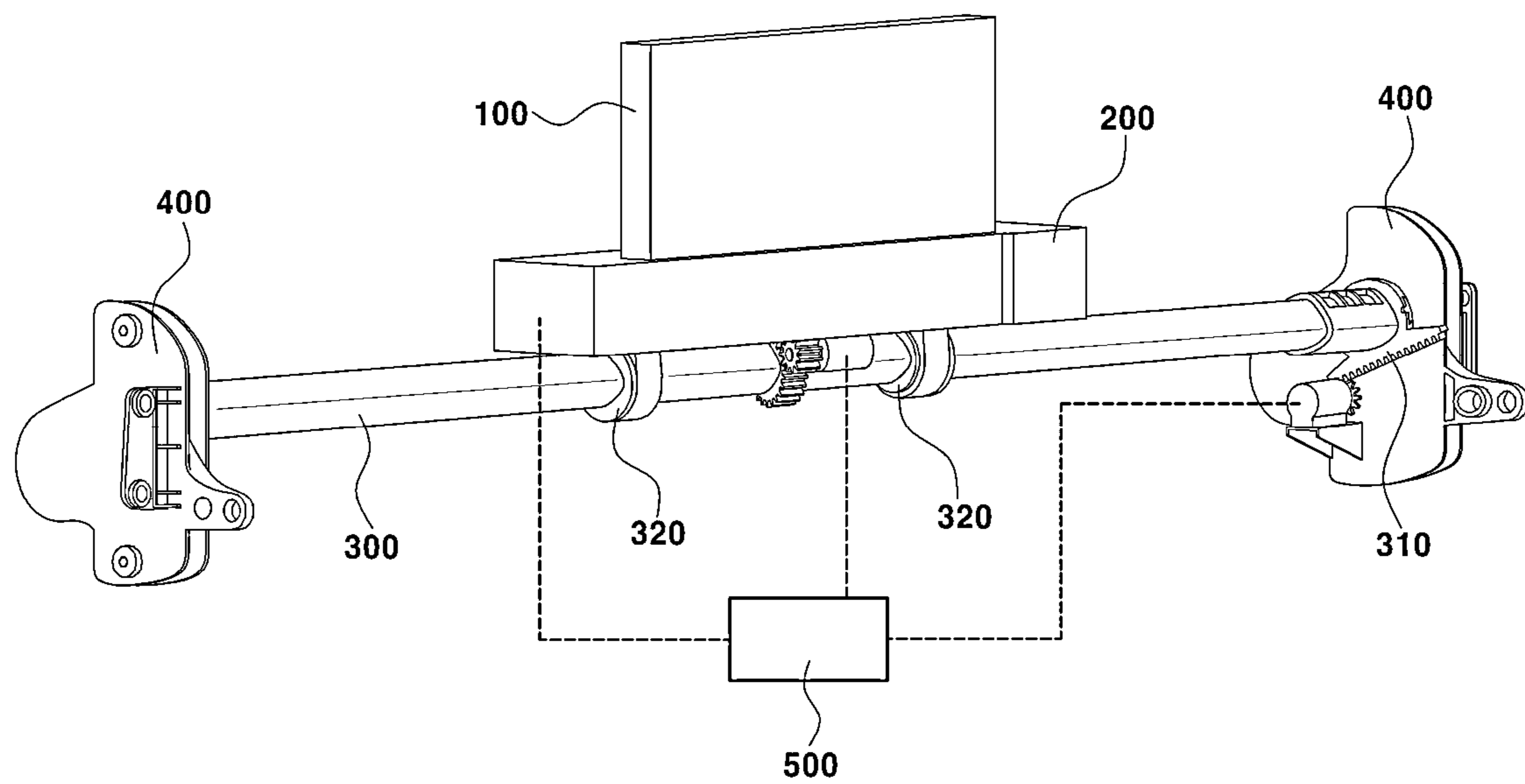


FIG. 4

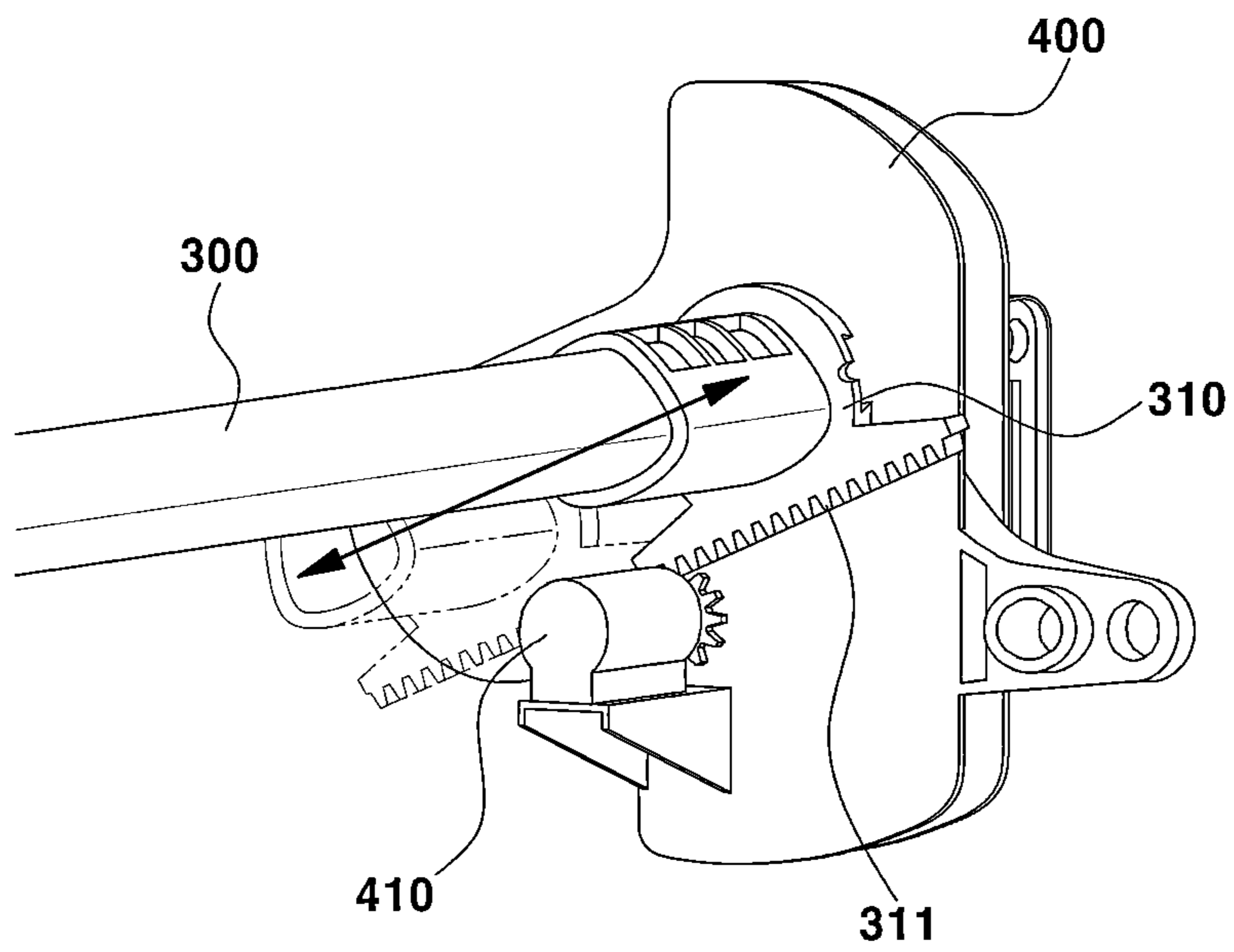


FIG. 5

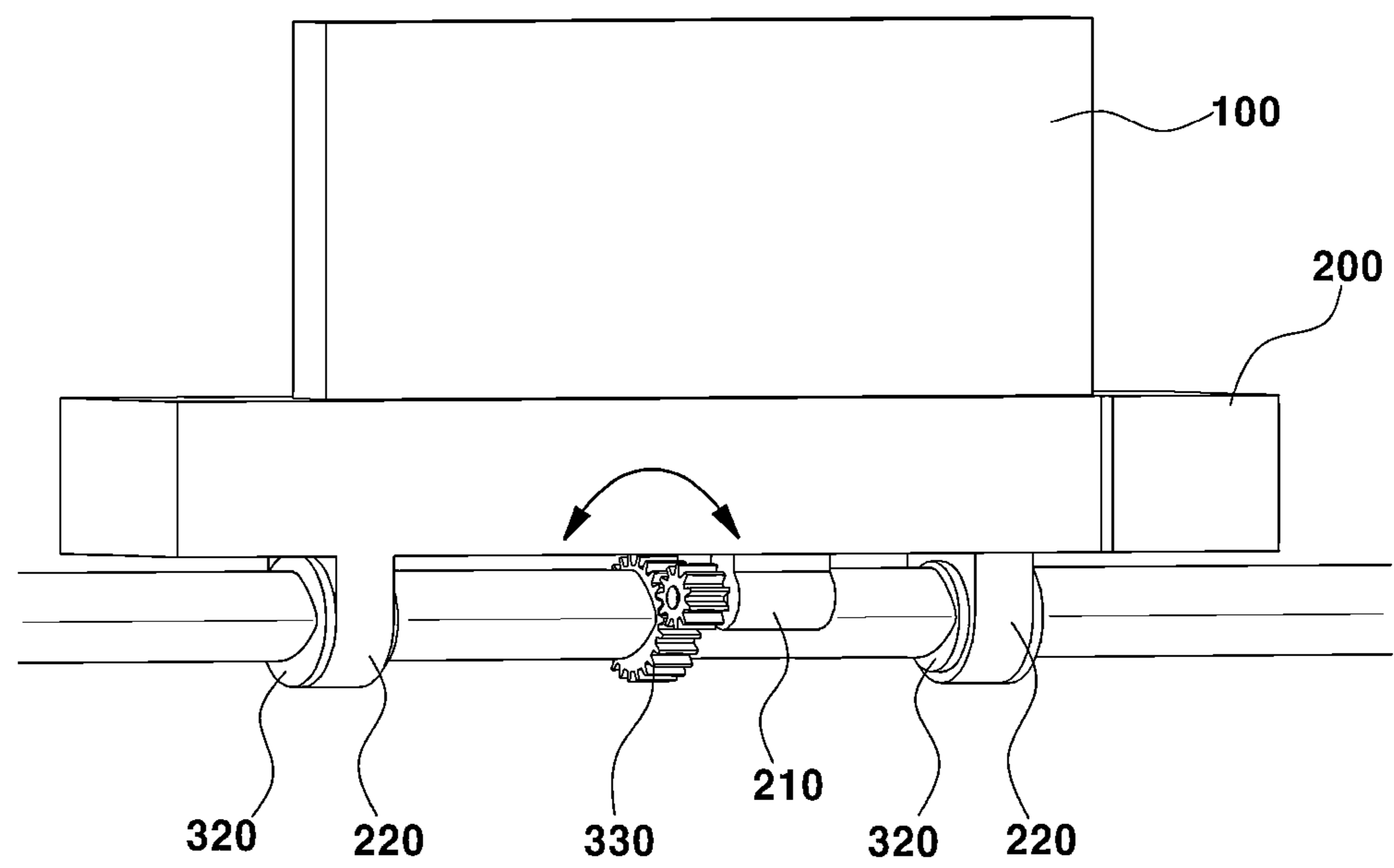


FIG. 6

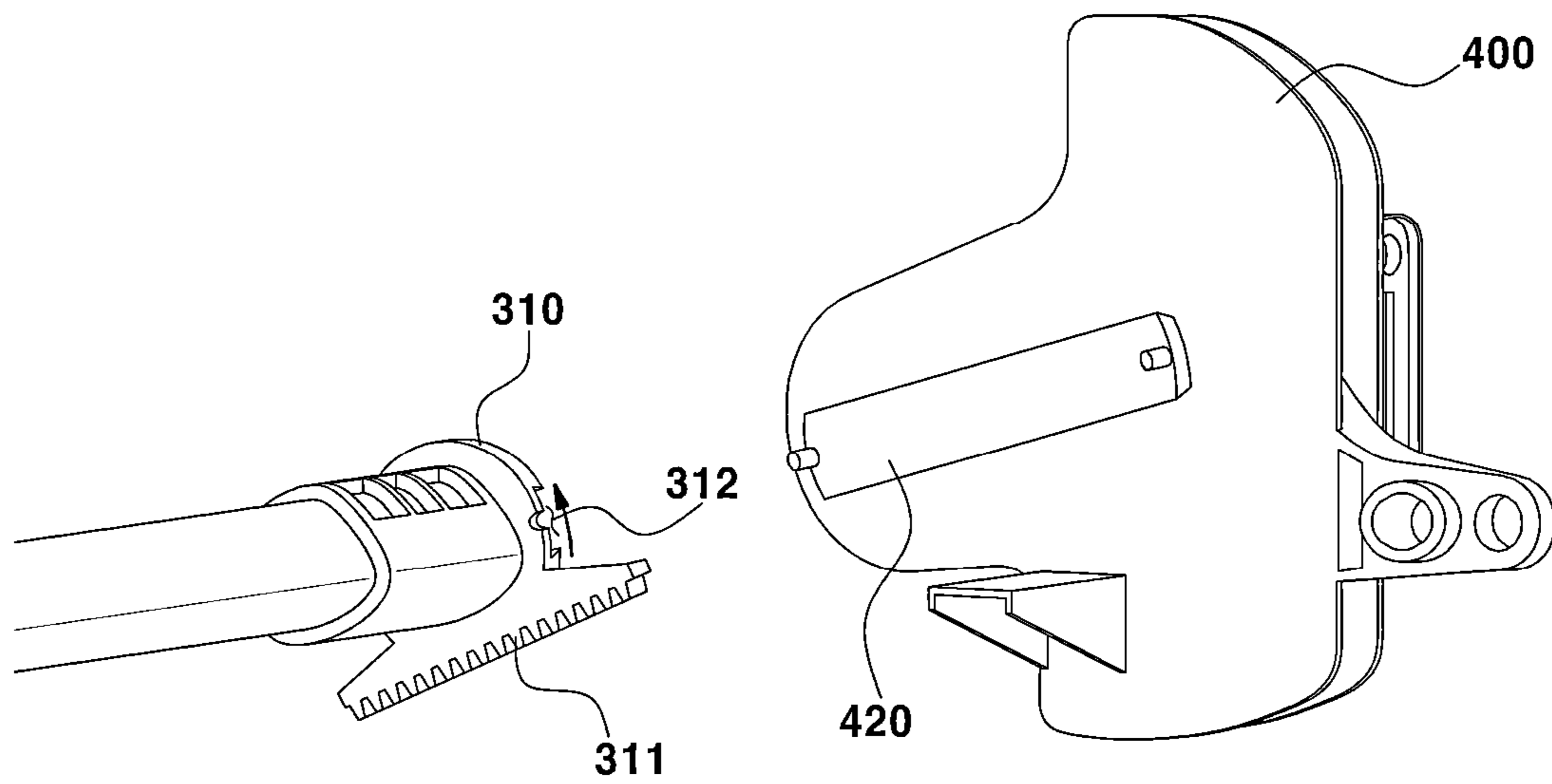


FIG. 7a

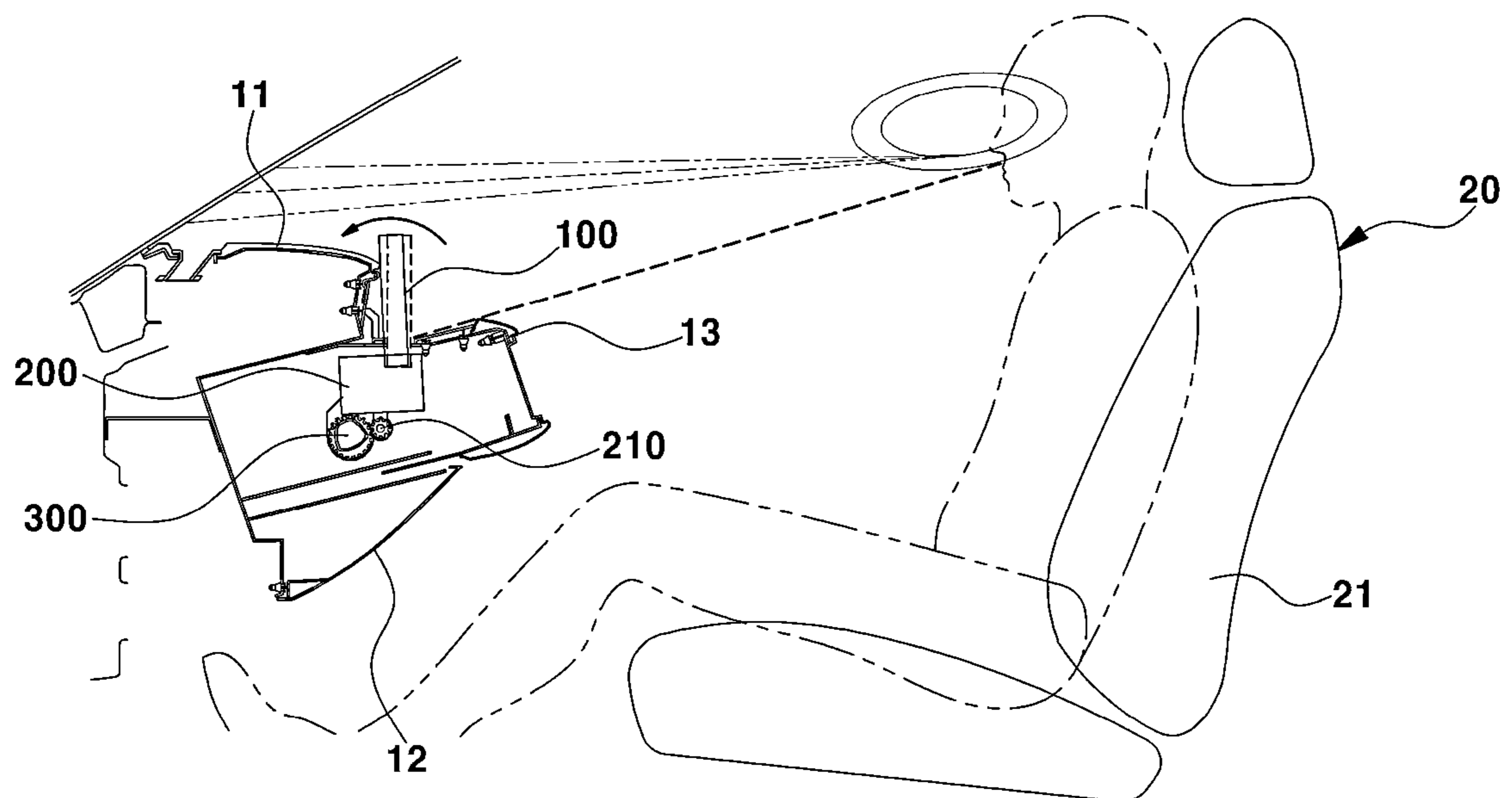


FIG. 7b

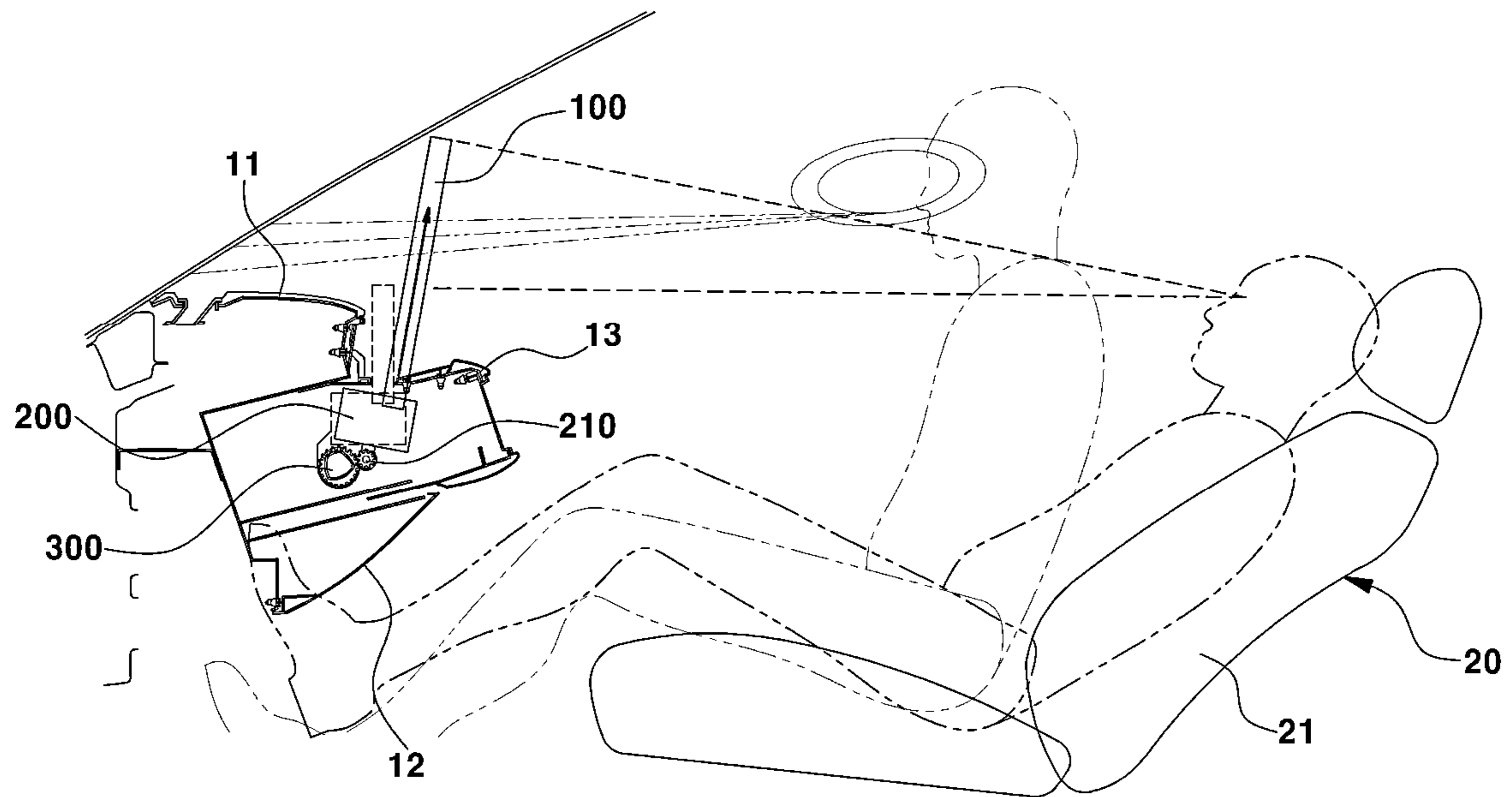
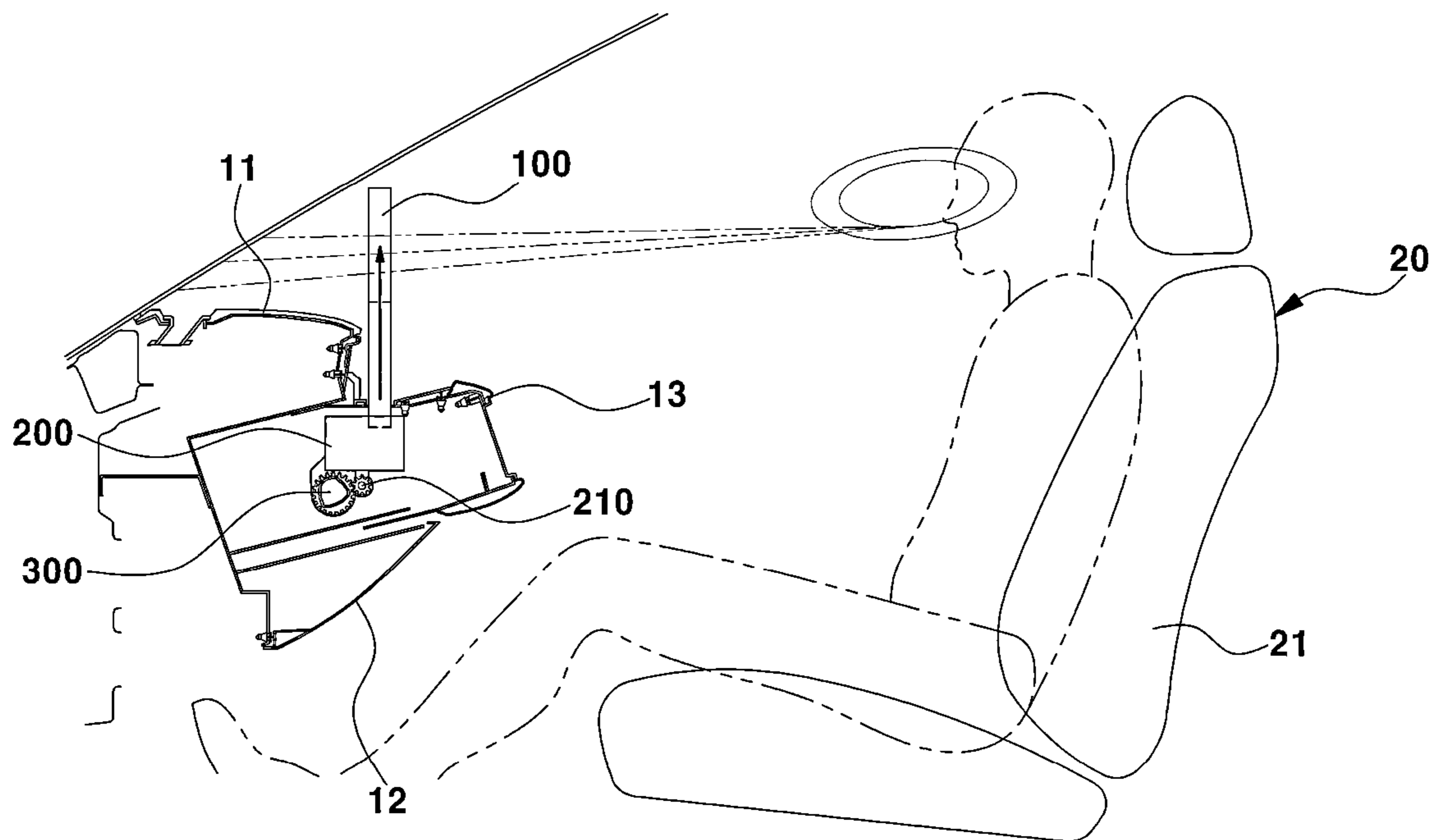


FIG. 7c



APPARATUS FOR DEPLOYING A DISPLAY UNIT

CROSS-REFERENCE TO RELATED APPLICATION

This application claims under 35 U.S.C. § 119(a) the benefit of priority to Korean Patent Application No. 10-2021-0001359 filed on Jan. 6, 2021, the entire contents of which are incorporated herein by reference.

BACKGROUND

(a) Technical Field

The present disclosure relates to an apparatus for deploying a display unit. More particularly, the present disclosure relates to an apparatus for deploying a display unit located inside a crash pad and for controlling tilting of the display unit in a forward-backward direction considering the traveling state or the state of a seat of a vehicle.

(b) Background Art

In general, a vehicle is provided with a display apparatus near the driver's seat thereof for providing a variety of pieces of information. The display apparatus may provide various information, such as information about a route from a point of departure to a destination and information about the current location of the vehicle.

In addition, the display apparatus may reproduce music or video, may receive terrestrial broadcasting signals or satellite broadcasting signals and display the same on a screen, and may provide information about the state of the vehicle or information for user convenience, such as weather and news.

A conventional vehicular display apparatus is configured such that a display unit thereof is deployed in a manner of being moved in a vertical direction using a lead screw from a state of being accommodated in a housing. However, because the speed at which the display unit is moved is determined by the pitch of the lead screw and the speed of a motor, there is a problem in that the driving speed is low and tilting of the display unit is impossible.

The above information disclosed in this Background section is only to enhance understanding of the background of this disclosure. Therefore, the Background section may contain information that does not form the related art that is already known in this country to a person of ordinary skill in the art.

SUMMARY

Therefore, there is a need to solve the above noted low speed and display unit tilt problems. Further, there is a need to develop a display unit capable of being actively controlled in response to a change in the driving environment or a change in the state of a seat. Furthermore, there is a need to develop technology for controlling tilting of a display unit and the distance between a user and a display unit in response to the external environment of a vehicle.

The present disclosure has been made in an effort to solve the above-described problems associated with the related art. It is an object of the present disclosure to provide an apparatus for deploying a display unit so that the angle of the display unit is controlled in consideration of the traveling state or the state of a seat of a vehicle.

It is another object of the present disclosure to provide an apparatus for deploying a display unit in a manner in which a cowl cross bar performs sliding movement, thereby changing the position of the display unit in consideration of the traveling state of a vehicle.

The objects of the present disclosure are not limited to the above-mentioned objects. Other objects not mentioned herein should be clearly understood by those having ordinary skill in the art from the following description and should become apparent with reference to the embodiments of the present disclosure. In addition, the objects of the present disclosure can be accomplished by the components described in the appended claims and combinations thereof.

In one aspect, the present disclosure provides an apparatus for deploying a display unit. The apparatus includes: a cowl cross bar disposed inside a crash pad; a housing disposed on the cowl cross bar and fastened to a center part of the crash pad; a display unit configured to be deployed along the housing; a rotating unit configured to rotate the housing with respect to the cowl cross bar; a driving unit coupled to the cowl cross bar in order to cause sliding movement of the cowl cross bar; and a controller configured to control at least one of the extent of deployment of the display unit, the amount of sliding movement of the cowl cross bar, or the amount of rotation of the housing.

In an embodiment, the driving unit may include a rack gear part, engaged with a side bracket fixed to the vehicle body. The driving unit may also include a driving part, disposed at the side bracket to apply driving force to the rack gear part so that the rack gear part moves along a guide part, provided at the side bracket, in the longitudinal direction of the guide part.

In another embodiment, the rotating unit may include a gear part, disposed around the outer surface of the cowl cross bar that faces the housing. The rotating unit may also include a rotating part, disposed at the housing to apply rotational force to the housing so that the housing is rotated along the gear part.

In still another embodiment, the apparatus may further include a link part disposed at a portion of the cowl cross bar to which the housing is fastened.

In yet another embodiment, the controller may control the extent of deployment of the display unit depending on the driving mode of the vehicle.

In still yet another embodiment, the controller may control the tilting angle of the display unit depending on the driving mode of the vehicle.

In another embodiment, the controller may control sliding movement of the center part depending on the driving mode of the vehicle.

In another embodiment, when a seatback is reclined to a predetermined angle or more, the controller may perform control such that the housing is rotated.

In still another embodiment, when a seat is rotated in a leftward-rightward direction to an angle greater than a predetermined angle, the controller may perform control such that the display unit is fully deployed from the housing and stands upright.

In yet another embodiment, the controller may control the tilting angle of the housing depending on the state of light introduced into the vehicle from an external light source present outside the vehicle.

Other aspects and embodiments of the disclosure are discussed hereinbelow.

It is understood that the terms "vehicle" or "vehicular" or other similar terms as used herein are inclusive of motor vehicles in general. Such motor vehicles include: passenger

automobiles including sports utility vehicles (SUV), buses, trucks, and various commercial vehicles; watercraft including a variety of boats and ships; aircraft; and the like. Such motor vehicles also include hybrid vehicles, electric vehicles, plug-in hybrid electric vehicles, hydrogen-powered vehicles, and other alternative fuel vehicles (e.g. fuels derived from resources other than petroleum). As referred to herein, a hybrid vehicle is a vehicle that has two or more sources of power, for example, vehicles that are both gasoline-powered and electric-powered.

The above and other features of the disclosure are discussed hereinbelow.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features of the present disclosure are described in detail with reference to several embodiments thereof, illustrated in the accompanying drawings, which are given hereinbelow by way of illustration only, and thus are not limitative of the present disclosure, and wherein:

FIG. 1 is a perspective view of an apparatus for deploying a display unit according to an embodiment of the present disclosure;

FIG. 2a is a side cross-sectional view showing the popped-up state of the apparatus for deploying a display unit according to an embodiment of the present disclosure;

FIG. 2b is a side cross-sectional view showing the pulled-down state of the apparatus for deploying a display unit according to an embodiment of the present disclosure;

FIG. 3 is a view showing the engagement relationship between a cowl cross bar and a housing according to an embodiment of the present disclosure;

FIG. 4 is a view showing the engagement relationship between the cowl cross bar and a side bracket according to an embodiment of the present disclosure;

FIG. 5 is a view showing the configurations of the cowl cross bar and the side bracket according to an embodiment of the present disclosure;

FIG. 6 is an enlarged view of the housing fastened to the cowl cross bar according to an embodiment of the present disclosure;

FIG. 7a is a view showing the deployed state of the display unit in a manual driving mode according to an embodiment of the present disclosure;

FIG. 7b is a view showing the deployed state of the display unit in an autonomous driving mode according to an embodiment of the present invention; and

FIG. 7c is a view showing the deployed state of the display unit upon swiveling of a seat according to an embodiment of the present disclosure.

It should be understood that the appended drawings are not necessarily to scale, presenting a somewhat simplified representation of various features illustrative of the basic principles of the disclosure. The specific design features of the present disclosure as disclosed herein, including, for example, specific dimensions, orientations, locations, and shapes, will be determined in part by the particular intended application and use environment.

In the figures, reference numbers refer to the same or equivalent parts of the present disclosure throughout the several figures of the drawings.

DETAILED DESCRIPTION

Hereinafter, embodiments of the present disclosure are described in detail with reference to the accompanying drawings. The present disclosure may, however, be embod-

ied in many different forms, and should not be construed as being limited to the embodiments set forth herein. Rather, these embodiments are provided so that the disclosure is thorough and complete, and fully conveys the scope of the disclosure to those having ordinary skill in the art.

The terms “- part”, “- unit”, and “- system” used in the specification mean units for processing at least one function or operation, and can be implemented as hardware components, software components, or combinations of hardware components and software components.

Further, in the following description, the terms “first” and “second” are used only to avoid confusing designated components, and do not indicate the sequence or importance of the components or the relationships between the components.

Further, in the following description, the term “forward direction” refers to a horizontal direction, corresponding to the direction in which a vehicle travels. The term “backward direction” refers to a direction opposite the forward direction.

Further, in the following description, a vehicle is described as capable of being driven in a manual driving mode and an autonomous driving mode. The manual driving mode refers to a mode in which a vehicle is manually driven by a driver. The autonomous driving mode refers to a mode in which a vehicle autonomously travels using, for example, an advanced driver assistance system (ADAS), without the intervention of a driver.

Further, tilting of a seat 20 refers to movement of a seatback 21 to a certain angle in the forward-backward direction of a vehicle. Swiveling of the seat 20 refers to movement of the seat 20 to a certain angle in the width direction of the vehicle.

Hereinafter, an embodiment is described in detail with reference to the accompanying drawings. The same or similar components are denoted by the same reference numerals throughout the specification, and a duplicate description thereof has been omitted.

The present disclosure relates to an apparatus for deploying a display unit 100. Specifically, the present disclosure relates to an apparatus for deploying a display unit 100 including a rollable display that is capable of being wound into and unwound out of a crash pad 10 provided in the occupant compartment of a vehicle.

The display unit 100 may be wound into a housing 200 by a winding unit located inside the housing 200. The display unit 100 may be configured as a flexible display.

Further, the present disclosure provides an apparatus for deploying a display unit 100, in which a center part 13 is driven so as to change the extent of deployment of the display unit 100, the angle formed by the display unit 100 and the crash pad 10, and the distance between the display unit 100 and a user sitting in a seat of a vehicle.

In addition, a rotating unit for rotating the housing 200 is included in order to tilt the display unit 100. Thus, the display unit 100 is capable of being rotated in the forward-backward direction.

FIG. 1 is a perspective view of a crash pad 10 at which an apparatus for deploying a display unit 100 according to an embodiment of the present disclosure is located.

As shown, the crash pad 10 includes an upper part 11, a lower part 12, and a center part 13, which is located between the upper part 11 and the lower part 12 in a height direction. The crash pad 10 further includes a housing 200, which accommodates the display unit 100 configured to protrude upwards from the center part 13. The crash pad 10 also includes a cowl cross bar 300, which is located inside the

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center part **13** so as to extend in the width direction of the vehicle and to be coupled at both ends thereof to side brackets **400**.

The housing **200** is located on the cowl cross bar **300**. A link part **320** is provided between the housing **200** and the cowl cross bar **300** so that the housing **200** is rotated in the forward-backward direction with respect to the cowl cross bar **300**. When the rotational force of the rotating unit is transmitted thereto, the link part **320** enables the housing **200** to be moved independently of the cowl cross bar **300**. The housing **200** may be configured to be rotated in the forward-backward direction with respect to the cowl cross bar **300**.

The cowl cross bar **300** may include an outer surface having a flat portion so that the link part **320** is engaged therewith. The link part **320** may be fixed to the cowl cross bar **300**. The housing **200** is located on the outer surface of the link part **320** and is configured to be rotated along the outer surface of the link part **320** about the center axis of the cowl cross bar **300**.

The center part **13** is configured to pop up into the occupant compartment of the vehicle. The cowl cross bar **300**, which is coupled to the inner side of the center part **13**, is moved along a guide part **420** located at each of the side brackets **400**, so the center part **13** fixed to the cowl cross bar **300** is moved in the longitudinal direction of the guide part **420**. The guide part **420** may be formed so as to be oriented in the longitudinal direction of the vehicle. The guide part **420** may be formed so as to be oriented at a predetermined angle in the height direction with respect to the horizontal plane of the vehicle body.

The center part **13** is integrally moved with the cowl cross bar **300** in the longitudinal direction of the guide part **420** by a controller **500**. When a user request or a signal for switching to the autonomous driving mode is received, the controller **500** performs control such that the center part **13** is moved to be inserted into the space between the upper part **11** and the lower part **12**.

The center part **13** may protrude out of the crash pad **10** from a fully pulled-down position to a fully popped-up position. The center part **13** may be located at a certain position between the fully pulled-down position and the fully popped-up position. When a signal for switching to the autonomous driving mode is received or when a user request is received in the manual driving mode, the controller **500** may perform control such that the center part **13** is moved to a certain position between the fully pulled-down position and the fully popped-up position.

According to an embodiment of the present disclosure, when the driving mode received by the controller **500** is the manual driving mode, the center part **13** is fully popped up. When the driving mode received by the controller **500** is the autonomous driving mode, the center part **13** is pulled down into the crash pad **10** and stops at a position at which the display is capable of being fully deployed.

Further, when the user inputs a command for turning off the display unit **100** in the autonomous driving mode, the controller **500** performs control such that the display unit **100** is wound into the housing **200** and the center part **13** is moved into the crash pad **10** and stops at the fully pulled-down position.

The controller **500** is configured to independently or simultaneously control the extent of deployment of the display unit **100** and the tilting angle of the display unit **100** depending on the driving mode of the vehicle. According to an embodiment, when the driving mode of the vehicle is the manual driving mode, the controller **500** may deploy the

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display unit **100** to a height lower than the maximum height to which the display unit **100** is fully deployed and may tilt the display unit **100** to a predetermined angle in the forward direction of the vehicle.

Conversely, when the driving mode of the vehicle is the autonomous driving mode, the controller **500** may fully deploy the display unit **100** and may tilt the display unit **100** in the backward direction of the vehicle. Further, in the autonomous driving mode, the controller **500** may perform control such that at least a portion of the center part **15** is inserted into the space between the upper part **11** and the lower part **12**.

The controller **500** may set the extent of deployment and tilting angle of the display unit **100** depending on the driving mode of the vehicle, the reclining angle of the seatback **21**, and the swiveling angle of the seat **20**.

In addition, the controller **500** may receive information about an external light source from a vision sensor, which is located inside or outside the occupant compartment of the vehicle. The controller **500** may measure the angle at which the light emitted from the external light source is introduced into the occupant compartment of the vehicle. Further, the controller **500** may deploy or tilt the display unit **100** based on the information about the external light source transmitted from the vision sensor. In the manual driving mode of the vehicle, the controller **500** may measure the quantity of external light introduced into the occupant compartment and the angle of incidence of external light using the vision sensor and may perform control such that the display unit **100** is tilted 5 to 10 degrees in the forward direction.

As described above, the controller **500** may control at least one of the extent of deployment of the display unit **100**, the tilting angle of the display unit **100**, or the position of the center part **13** depending on at least one of the driving mode of the vehicle, the reclining angle of the seatback **21**, or the swiveling angle of the seat **20**.

FIG. *2a* is a cross-sectional view showing the state in which the cowl cross bar **300** slides along the guide part **420** in the backward direction of the vehicle and the center part **13** is fully popped up. FIG. *2b* is a cross-sectional view showing the state in which the cowl cross bar **300** slides along the guide part **420** in the forward direction of the vehicle and the center part **13** is fully pulled down.

In other words, the center part **13** may be moved between the fully pulled-down position and the fully popped-up position according to the movement of the cowl cross bar **300** along the guide part **420** located at each of the side brackets **400** mounted to the vehicle body.

According to an embodiment of the present disclosure, when the display unit **100** is fully deployed, the controller **500** may perform control such that the housing **200** is tilted to a predetermined angle in the backward direction of the vehicle and at least a portion of the center part **13** is inserted into the crash pad **10**. Further, when a signal for switching to the manual driving mode or a user request is received, the controller **500** controls a driving unit **310** to fully pop up the center part **13**.

According to another embodiment of the present disclosure, the controller **500** is configured to independently set the extent of deployment of the display unit **100** and the tilting angle of the display unit **100** depending on the state of the center part **13**.

FIG. *3* shows the housing **200**, located on the cowl cross bar **300**, and the side brackets **400**, coupled to the two ends of the cowl cross bar **300** according to an embodiment of the present disclosure.

The housing 200 is located on the middle portion of the cowl cross bar 300 and surrounds the outer surface of the cowl cross bar 300. The housing 200 may be configured to be coupled to the outer surface of the link part 320, which is located on the outer surface of the cowl cross bar 300. The housing 200 is rotated along the link part 320 about the center of the cowl cross bar 300 in the longitudinal direction. When the housing 200 is rotated, the display unit 100, which is deployed upwards from the housing 200, is integrally rotated with the housing 200.

The two ends of the cowl cross bar 300 are coupled to the side brackets 400 fixed to the vehicle body. Driving units 310 are provided between the two ends of the cowl cross bar 300 and the side brackets 400. Each of the driving units 310 may surround at least a portion of the cowl cross bar 300.

The driving unit 310 is formed such that one surface thereof surrounds at least a portion of the end of the cowl cross bar 300 and the opposite surface thereof faces the side bracket 400. The side bracket 400 is provided with a guide part 420, to which at least a portion of the driving unit 310 is coupled. The guide part 420 may include an elevated flat surface, and the driving unit 310 may be inserted into the space between the upper surface of the side bracket 400 and the elevated flat surface of the guide part 420.

The driving unit 310 includes a rack gear part 311 formed to be substantially parallel to the guide part 420. The driving unit 310 receives the driving force of a driving part 410, which is provided at the side bracket 400, so as to move the cowl cross bar 300 in the longitudinal direction of the guide part 420.

The controller 500 controls the driving force of the driving part 410 so as to control the movement of the rack gear part 311 in the longitudinal direction. The rack gear 311 is integrally formed with the driving unit 310. The extent to which the center part 13 protrudes upwards from the crash pad 10 is set by varying the extent to which the driving part 410 is driven.

FIG. 4 shows the driving unit 310 and the cowl cross bar 300, which are coupled to the side bracket 400. FIG. 5 shows the configurations of the side bracket 400, the cowl cross bar 300, and the driving unit 310.

The rack gear part 311 is tooth-engaged with the driving part 410 fixed to the side bracket 400 so as to be moved by the driving force of the driving part 410. Further, at least a portion of the driving unit 310 is inserted into the side bracket 400, which includes the guide part 420, so that the driving unit 310 is capable of being moved in the longitudinal direction of the guide part 420.

The driving unit 310 may include a slot portion 312 formed therein to allow the elevated flat surface of the guide part 420 to be inserted thereinto. When the rotational force of the driving part 410 is applied to the driving unit 310, the slot portion 312 is moved along the guide part 420. Accordingly, the cowl cross bar 300 is integrally moved with the driving unit 310 in the longitudinal direction of the guide part 420.

The guide part 420 may be formed so as to be oriented in the longitudinal direction of the vehicle. The guide part 420 may be formed so as to be oriented at a predetermined angle with respect to the longitudinal direction of the vehicle. The shape of the guide part 420 may be set depending on the position at which the center part 13 is popped up and the height to which the center part 13 is popped up. The rack gear part 311 is moved along the guide part 420. Accordingly, the cowl cross bar 300, to which the driving unit 310 including the rack gear part 311 is coupled, is integrally

moved with the center part 13 according to the movement of the rack gear part 311 in the longitudinal direction of the guide part 420.

In the state in which the front end of the rack gear part 311 is engaged with the driving part 410, the center part 13 is maintained in the state of being fully popped up into the occupant compartment of the vehicle. In the state in which the rear end of the rack gear part 311 is engaged with the driving part 410, the center part 13 is maintained in the state of being fully pulled down into the crash pad 10.

In this way, the extent to which the center part 13 protrudes from the front surface of the crash pad 10 is determined by the extent to which the driving part 410 is driven and the engagement position between the rack gear part 311 and the driving part 410.

FIG. 6 shows the configuration of the rotating unit, which is configured to rotate the housing 200, coupled to the cowl cross bar 300, in the forward-backward direction of the vehicle.

The housing 200 is coupled to at least a portion of the cowl cross bar 300. The housing 200 includes therein a winding part (not shown) for winding the rollable display. The housing 200 includes an opening formed in the upper end thereof to deploy the display unit 100 therethrough and includes a fastening part 220 formed at the lower end thereof to be fastened to the cowl cross bar 300. The fastening part 220 is formed so as to surround the link part 320 located on the outer surface of the cowl cross bar 300 and to be rotatable relative to the link part 320.

A gear part 330 may be fixedly provided around the outer surface of the cowl cross bar 300 at a position adjacent to the link part 320. The housing 200 includes a rotating part 210 provided on the lower surface thereof at a position adjacent to the cowl cross bar 300 so as to be engaged with the gear part 330.

According to an embodiment of the present disclosure, the rotating part 210 may be implemented as a motor, and a gear may be connected to the rotating shaft of the motor. The gear connected to the rotating shaft of the motor meshes with the gear part 330 fixed to the cowl cross bar 300. Thus, the housing 200 is capable of being rotated about the center axis of the cowl cross bar 300 in the forward-backward direction of the vehicle.

The link part 320 is coupled to the cowl cross bar 300. The fastening part 220 of the housing 200 is disposed so as to surround the outer surface of the link part 320 and to be rotatable relative to the link part 320. Accordingly, when the driving force of the motor disposed on the lower surface of the housing 200 is applied to the gear part 330, the housing 200 is rotated along the link part 320.

According to an embodiment of the present disclosure, the housing 200 may be rotated 5 degrees in the forward direction of the vehicle and 15 degrees in the backward direction of the vehicle. The housing 200 may be rotated freely within a region in which the upper part 11 of the crash pad 10 and the display unit 100 do not interfere with each other. Further, the extent to which the housing 200 is rotated may be automatically controlled by the controller 500 depending on the reclining angle of the seat 20, the rotating angle (swiveling angle) of the seat 20 in the leftward-rightward direction, and the traveling state of the vehicle.

The controller 500 receives information about the reclining angle of the seat 20 and controls the rotating part 210 based on the received information about the reclining angle of the seat 20 such that the housing 200 is rotated corresponding to the angle of the seatback 21 of the seat 20. Further, the controller 500 receives information about the

swiveling angle of the seat **20** and controls the rotating part **210** of the housing **200** such that the display unit **100** is oriented vertically in the height direction of the vehicle.

Furthermore, when the center part **13** is moved to a position adjacent to the fully pulled-down position by the sliding movement of the cowl cross bar **300** along the guide part **420**, the controller **500** rotates the housing **200** to a predetermined angle so that the display unit **100** does not interfere with the upper part **11** of the crash pad **10**.

FIG. *7a* shows the tilting angle of the display unit **100** in the manual driving mode of the vehicle.

In the manual driving mode, the display unit **100** needs to be tilted to a predetermined angle in the forward direction of the vehicle in order to secure the user's view. To this end, the controller **500** rotates the housing **200** such that the display unit **100** is tilted 5 degrees in the forward direction of the vehicle.

In other words, when the driving mode of the vehicle is switched to the manual driving mode, the controller **500** tilts the display unit **100** in the forward direction of the vehicle so that the display unit **100**, deploying upwards from the housing **200**, does not obstruct the user's view. Accordingly, the display unit **100** is located in the state of being tilted to a predetermined angle below the user's field of vision in front of the vehicle.

FIG. *7b* shows the tilting angle of the display unit **100** when the vehicle is driven in the autonomous driving mode or when the reclining angle of the seat **20** exceeds a reference angle set by the controller **500**.

As shown, when a signal for switching to the autonomous driving mode is received or when the reclining angle of the seat **20** exceeds a set reference angle, the controller **500** performs control such that the display unit **100** is tilted to the maximum extent in the backward direction of the vehicle so as to substantially correspond to the reclining angle of the seatback **21**. In other words, when the vehicle is driven in the autonomous driving mode or when the seat **20** is reclined backwards to an angle exceeding a reference angle set by the controller **500**, the controller **500** controls the rotating part **210** to tilt the housing **200** to the maximum extent in the backward direction of the vehicle such that the front surface of the display unit **100** is oriented obliquely downwards. Accordingly, the position of the display unit **100** is changed so that the front surface thereof comes within the user's field of vision.

When the reclining angle of the seat **20** exceeds a set reference angle (a relaxation mode) in the autonomous driving mode of the vehicle, the controller **500** may perform control such that the display unit **100** is fully deployed and may control the driving part **410** such that the center part **13** is fully pulled down.

In this way, in the relaxation mode, the controller **500** controls the extent of deployment and the tilting angle of the display unit **100** so as to increase the driver's convenience and controls the driving part **410** such that the center part **13** is fully pulled down, thereby increasing the amount of indoor space in the vehicle.

FIG. *7c* is a side view showing the angle to which the display unit **100** is deployed in a swiveled state of the seat **20**.

When the seat **20** is swiveled, i.e., rotated in the leftward-rightward direction so that the driver is capable of viewing the passenger sitting in the front-row seat, the controller **500** determines that the seat **20** is in a swiveled state and performs control such that the display unit **100** is fully deployed vertically in the height direction of the vehicle.

This state may be used as a conversation mode enabling conversation between the occupants sitting in the front-row seats. At this time, the display unit **100** is fully deployed so that the occupants are capable of sharing the screen of the display unit **100**. In other words, the display unit **100** and the center part **13** are controlled such that the display unit **100** is fully deployed vertically in the height direction of the vehicle so as to enable the occupants sitting in the front-row seats and the back-row seats to share an image displayed on the display unit **100**.

In an embodiment of the present disclosure, when the seat **20** is rotated in the leftward-rightward direction to an angle greater than a first set angle, the controller performs control such that the display unit **100** is fully deployed from the housing and stands upright in the height direction of the vehicle.

Conversely, when the seat **20** is rotated in the leftward-rightward direction to an angle less than or equal to the first set angle, the controller performs control such that the display unit **100** is drawn into the housing and the center part is inserted into the crash pad. As an example of the present disclosure, the first set angle may be set to a rotation angle of 90 degrees to the left and the right with respect to the center portion of the seat. The first set angle may be set differently depending on the angle to which the seat can be swiveled.

As should be apparent from the above description, the present disclosure provides the following effects through the above embodiments and through the configurations and combination and use relationships described above.

The apparatus for deploying a display unit according to the present disclosure controls the tilting angle of the display unit depending on the traveling state of a vehicle, thereby providing an optimum field of vision to a user who intends to view information displayed on the display unit.

In addition, the apparatus for deploying a display unit according to the present disclosure controls the tilting angle of the display unit and the distance between a user and the display unit depending on the state of a seat, thereby improving user convenience.

The above description is illustrative of the present disclosure. Also, the above disclosure is intended to illustrate and explain various embodiments of the present disclosure. The embodiments of the present disclosure may be used in various other combinations, modifications, and environments. In other words, the various embodiments may be changed or modified within the scope of the concept of the disclosure disclosed herein, within the equivalent scope of the disclosure, and/or within the skill and knowledge of one having ordinary skill in the art. The described embodiments illustrate the best state of the art to implement the technical idea of the present disclosure. Various changes may be made thereto as demanded for specific applications and uses of the present disclosure. Accordingly, the above description is not intended to limit the present disclosure to the embodiments. Also, the appended claims should be construed as encompassing such other embodiments.

What is claimed is:

1. An apparatus for deploying a display unit, the apparatus comprising:

- a cowl cross bar disposed inside a crash pad so as to be coupled to a center part of the crash pad;
- a housing disposed on the cowl cross bar;
- a display unit configured to be deployed along the housing; and
- a rotating unit configured to rotate the housing with respect to the cowl cross bar.

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2. The apparatus of claim 1, further comprising:
 a driving unit coupled to the cowl cross bar in order to
 cause sliding movement of the cowl cross bar; and
 a controller configured to control at least one of an extent
 of deployment of the display unit, an amount of sliding
 movement of the cowl cross bar, or an amount of
 rotation of the housing.

3. The apparatus of claim 2, wherein the driving unit
 comprises:

a rack gear part engaged with a side bracket fixed to a
 vehicle body; and

a driving part disposed at the side bracket to apply a
 driving force to the rack gear part so that the rack gear
 part moves along a guide part, provided at the side
 bracket, in a longitudinal direction of the guide part.

4. The apparatus of claim 1, wherein the rotating unit
 comprises:

a gear part disposed around an outer surface of the cowl
 cross bar that faces the housing; and

a rotating part disposed at the housing to apply a rotational
 force to the housing so that the housing is rotated along
 the gear part.

5. The apparatus of claim 4, further comprising:

a link part disposed at a portion of the cowl cross bar to
 which the housing is fastened.

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6. The apparatus of claim 2, wherein the controller
 controls an extent of deployment of the display unit depend-
 ing on a driving mode of a vehicle.

7. The apparatus of claim 2, wherein the controller
 controls a tilting angle of the display unit depending on a
 driving mode of a vehicle.

8. The apparatus of claim 2, wherein the controller
 controls sliding movement of the center part depending on
 a driving mode of a vehicle.

9. The apparatus of claim 2, wherein, when a seatback is
 reclined to a predetermined angle or more, the controller
 performs control such that the housing is rotated.

10. The apparatus of claim 2, wherein, when a seat is
 rotated in a leftward-rightward direction to an angle greater
 than a first set angle, the controller performs control such
 that the display unit is fully deployed from the housing and
 stands upright.

11. The apparatus of claim 2, wherein, when a seat is
 rotated in a leftward-rightward direction to an angle less
 than or equal to a first set angle, the controller performs
 control such that the display unit is drawn into the housing
 and the center part is inserted into the crash pad.

12. The apparatus of claim 2, wherein the controller
 controls a tilting angle of the housing depending on a state
 of light introduced into a vehicle from an external light
 source present outside the vehicle.

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